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(54) **All-weather type pavement marking sheet material.**

(57) In an all-weather type pavement marking sheet material, glass microspheres having refractive index of 1.5 - 1.9 (A) and glass microspheres having refractive index of 2.0 - 2.4 (B) are embedded mixedly and at least partially in a portion of a base sheet (1) made of rubber, synthetic resin or the like. This portion (S) is formed at intervals in the longitudinal direction of the base sheet or continuously in the longitudinal direction of the base sheet in a part of the base sheet as viewed in the transverse direction of the base sheet. The pavement marking sheet material has an excellent visibility during night and particularly when it is raining.

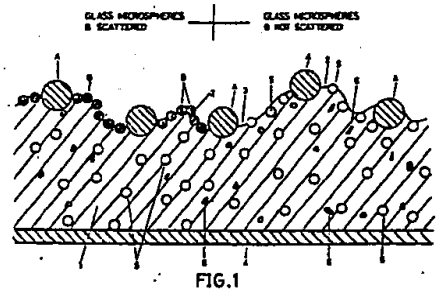

FIG.1

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Description

All-weather type pavement marking sheet material

This invention relates to a pavement marking sheet material and, more particularly, to an all-weather type pavement marking sheet material having an excellent visibility during night and particularly when it is raining.

Pavement marking materials which are presently used for pavement marking purposes all have glass microspheres dispersed on the surface thereof or mixed in the material for affording visibility during night. These pavement marking materials have the common disadvantage that, when the surface of the marking material is covered with a film of water when it is raining, upper hemisphere portions of the glass microspheres exposed above the surface of the marking material and performing a light reflecting function are mostly submerged in the water film with a result that the light reflecting function is impaired and visibility during night when it is raining becomes extremely poor.

For improving visibility of the marking materials during night when it is raining, some proposals have been made in the past. For example, Japanese Patent Publication No. 29060/1970 discloses a glass microspheres marking material comprising glass microspheres of low refractive index below 1.55 and colored or uncolored glass microspheres of medium refractive index of 1.65 - 1.85 of 10% - 60% in weight percent mixed together and further comprising adhesive mixed in these glass microspheres.

Japanese Patent Publication No. 48735/1977 discloses an all-weather type pavement marking material which comprises glass microspheres having refractive index of 1.55 or less and glass microspheres having a high refractive index of 2.0 - 2.3 mixed together or on which such glass microspheres having refractive index of 1.55 or less and those having refractive index of 2.0 - 2.3 are dispersed on the surface of the marking material substantially simultaneously when the marking material is applied on the pavement. Japanese Patent Publication No. 9460/1978 discloses a method of applying an all-weather type pavement marking line according to which, in dispersing glass microspheres on a coated surface of a pavement marking material by flowing glass microspheres onto the pavement marking material, there are provided a surface on which glass microspheres having refractive index of 1.6 or less are dispersed and a surface on which glass microspheres having refractive index of 1.9 or more are dispersed, both surfaces being provided in the form of a belt extending in the longitudinal direction of the pavement marking material. Japanese Patent Publication No. 9461/1978 discloses a method of applying an all-weather type pavement marking line according to which, in dispersing glass microspheres for light-reflection during night on an undried coated surface of a pavemet marking material, 10% - 60% in weight percent of the glass microspheres to be dispersed consists of high refractive glass microspheres having refractive index of 1.9 or more and the rest of the glass microspheres consists of low refractive glass microspheres having refractive index of 1.6 or less and these two kinds of glass microspheres are dispersed one after the other on the entire surface of the coated surface of the marking material. The techniques disclosed in these publications are all intended to provide a pavement marking method exhibiting visibility in all weather conditions except for snow by the combined use of relatively high refractive glass microspheres which have sufficient retro-reflective property, i.e., brightness in reflection, when they are covered with a water film due to rain during night but are expensive and have a relatively low brightness in reflection in weather conditions except for rain and relatively low refractive glass microspheres which lose brightness in reflection when they are covered with a water film due to rain during night but are cheap and have a sufficient brightness in reflection in weather conditions except for rain, thus making most of the merits of the respective glass microspheres and making up for the defects of the respective glass microspheres by the merits of each other.

These techniques all disclose an art in which glass microspheres are bonded directly to the pavement surface with a traffic paint. Aside from these techniques, Japanese Preliminary Patent Publication No. 238505/1985 discloses a pavement marking sheet material which is a pavement marking material preformed in the form of a sheet and is bonded on the pavement surface in use. In this sheet material, a surface sheet of a thickness of 1 mm or less consisting of a base layer in which reflex-reflecting elements such as glass microspheres are disposed on the surface thereof and a transparent and flat surface layer covering the base laer is bonded to the entire surface or a part of the surface of a base sheet of a thickness of 3 mm or less made of a material having an excellent conformability to the pavement surface selected from materials such as rubber, synthetic resin and the like. This pavement marking sheet material is intended to maintain good visibilty during night when it is raining by reflection of light by the reflex-reflecting elements covered with the cover layer while holding the total thickness of the sheet material at 4 mm or less.

The pavement marking methods disclosed in the above describved Japanese Patent Publications No. 29060/1970, No. 48735/1977, No. 9460/1978 and No. 9461/1978 according to which glass microspheres are bonded directly on the pavement surface with traffic paint require a strict temperature control in applying the material on the pavement surface and, in addition, require a complicated apparatus and the speed of application is rather slow. The pavement marking sheet material disclosed in the above described Japanese Preliminary Patent Publication No. 238505/1985 realizes a simplified application as compared with the above described pavement marking methods since the material is preformed in the form of a sheet. This pavement marking sheet material, however, requires an extra manufacturing step for adhereing two kinds of sheets produced separately together with a resulting high manufacturing cost.

It is, therefore, an object of the invention to provide an all-weather type pavement marking sheet material

having an excellent visibility during night when it is raining which can be applied on the pavement surface more easily and quickly and can be manufactured at a reduced cost.

The pavement marking sheet material achieving the above described object of the invention is characterized in that it comprises a base sheet made of rubber, synthetic resin or the like, and glass microspheres having refractive index of 1.5 - 1.9 and glass microspheres having refractive index of 2.0 - 2.4 embedded mixedly and at least partially in a portion of the base sheet, said portion being formed at intervals in the longitudinal direction of the base sheet or continuously in the longitudinal direction of the base sheet in a part of the base sheet as viewed in the transverse direction of the base sheet.

According to the invention, since the portion in which the glass microspheres having refractive index of 2.0 - 2.4 which can maintain reflex-reflectivity during night even if they are covered with a water film due to rain are embedded in the base sheet is provided at intervals in the longitudinal direction of the base sheet or continuously in the longitudinal direction of the base sheet in a part of the base sheet as viewed in the transverse direction of the base sheet, this portion has an excellent visibility during night when it is raining and, accordingly, drivers of automobiles can readily recognize the pavement marking sheet material in such weather condition if the pavement marking sheet material is used as, e.g., a center line of the pavement. In weather conditions other than rain during night, the glass microspheres having refractive index of 1.5 - 1.9 contribute to brightness in reflection in addition to the glass microspheres having refractive index of 2.0 - 2.4.

Since the pavement marking sheet material according to the invention is so constructed that the two different kinds of glass microspheres are dispersed on the preformed base sheet, the strict temperature control and the complicated applicating appratus as required in applying the prior art pavement marking methods causing the glass microspheres to be bonded directly on the pavement surface can be obviated and the application work can be done with a remarkably increased speed. Moreover, according to the invention, the two different kinds of microspheres are dispersed not in a state in which the two kinds of microspheres are superposed one upon the other or in paralle to each other as has been proposed in the prior art methods but in such a manner that the high refractive glass microspheres which are relatively expensive are dispersed at intervals in the longitudinal direction of the base sheet or dispersed continuously in the longitudinal direction of the base sheet in a part of the base sheet as viewed in the transverse direction of the base sheet. This contributes greatly to reduction in the manufacturing cost of the pavement marking sheet material without sacrificing brightness in reflection during night when it is raining. If compared with the prior art pavement marking sheet material in which two separately produced sheets are adhered to each other in manufacturing, the pavement marking sheet material according to the invention does not require such separate production of the two kinds of sheets so that the sheet material can be manufactured at a reduced cost.

Embodiments of the invention will now be described in conjunction with the accompanying drawings.

In the accompanying drawings,

Fig. 1 is an enlarged sectional view schematically showing an embodiment of the pavement marking sheet material according to the invention; and

Figs. 2, 3, 4 and 5 are views showing examples of manner of disposing the portion in which the glass microspheres having refractive index of 2.0 - 2.4 are dispersed.

The glass microspheres having refractive index of 1.5 - 1.9 used in the sheet material of the present invention (hereinafter referred to as "glass microspheres A") have a diameter of 50 μm - 1,000 μm, preferably 100 μm - 500 μm (average diameter of 350 μm). If the diameter is less than 50 μm, the glass microspheres will be embedded too deeply in the base sheet in the embossing step with resulting decrease in brightness of reflection and, besides, they will tend to be readily covered with a water film when it rains with resulting decrease in brightness in reflection. If, on the other hand, the diameter exceeds 1,000 μm, the base sheet tends to be injured by the embedded glass microspheres so that such diameter is undesirable. The glass microspheres having refractive index of 2.0 - 2.4 (hereinafter referred to as "glass microspheres B") have a diameter of 50 μm - 350 μm (average diameter of 70 μm). If the diameter is less than 50 μm, the glass microspheres will be embedded too deeply in the base sheet in the embossing step whereas if the diameter exceeds 350 μm, they will be too expensive to allow a commercial use in such sheet material.

For attaining a high brightness in reflection, the glass microspheres A should preferably be dispersed uniformly and continuously over the entire surface of the base sheet. If, however, an adequate brightness in reflection is obtainable owing to conditions of the pavement, the glass microspheres A may be partially dispersed at intervals in the longitudinal direction of the base sheet or may be continuously dispersed in the longitudinal direction of the base sheet in a part of the base sheet as viewed in the transverse direction of the base sheet. The glass microspheres B are dispersed not uniformly over the entire surface of the base sheet but at intervals in the longitudinal direction of the base sheet or, alternatively, continuously in the logitudinal direction of the base sheet in a part of the base sheet as viewed in the transverse direction of the base sheet. For this purpose, a portion S in which both the glass microspheres A and B exist may be disposed in various manners such, for example, as in the form of a belt-like section extending normally to the longitudinal direction of the base sheet as shown in Fig. 2, as in the form of a belt-like section extending obliquely with respect to the longitudinal direction of the base sheet as shown in Fig. 3, as in the form of a broken line in the longitudinal direction of the base sheet as shown in Fig. 4 and as in the form of a belt extending continuously in the longitudinal direction of the base sheet in a part of the base sheet as viewed in the transverse direction of the base sheet as shown in Fig. 5.

There is no particular limitation on the width and interval of the portion S in which both the glass

microspheres A and B exist. The width and interval of the portion S may be suitably determined so that a sufficeint brightness in reflection may be obtained depending upon conditions of the pavement on which the pavement marking sheet material is applied.

Preferable ratios of dispersion of the glass microspheres A and B in the portion S in which the glass microspheres A and B coexist are ones in which the glass microspheres A are dispersed over 30% - 40% of the area of a flat sheet before embossing and the glass microspheres B are dispersed over 50% - 85% (preferably 70% - 80%) of the area of the flat sheet before embossing remaining after the glass microspheres A have been dispersed. If the amount of dispersion of the glass microspheres A is less than 30%, a sufficient brightness in refiection cannot be obtained whereas if the amount of dispersion of the glass microspheres A exceeds 40%, vehicles running over the pavement marking sheet material tend to slip and therefore is undesirable. If the amount of dispersion of the glass microspheres B is less than 50%, a sufficient brightness in reflection cannot be obtained whereas the amount of dispersion of 85% is considered to be a maximum possible value of dispersion.

The base sheet requires to be made of a material having excellent conformability to the irregular pavement surface and durability to various mechanical forces. The base sheet therefore comprises, as its main ingredient, unvulcanized synthetic rubber such, for example, as acrilonitrile-butadiene rubber (NBR), isobutylene-isoprene rubber (IIR), chloroprene rubber (CR), chloro-sulphonyl-polyethylene, a urethane rubber or a synthetic resin such, for example, as polyvinyl chloride. The base sheet may comprise, if necessary, additives including a filler such as calcium carbonate powder, a pigment for providing color to the base sheet, small glass microspheres and wear resisting particles. The mixture of these ingredients is formed into a sheet with a thickness of 5 mm or less by passing it through pressure rolls or by other convenient methods. If the small glass microspheres are mixed in the base sheet, small glass microspheres having a diameter not exceeding about 500 μm may be employed and those of about 70 μm - 100 μm in average diameter may be conveniently employed.

An adhesive layer of a suitable thickness of 50 μm or more, preferably about 100 μm - 200 μm, is provided under the lower surface of the base sheet. A release paper is normally attached to the lower surface of the adhesive layer but it may be omitted depending upon the type of the adhesive employed in the adhesive layer.

For making the base sheet, the unvulcanized synthetic rubber or synthetic resin which is an ingredient of the base sheet is added with desired amount of the filler, pigment, small glass microspheres and other materials if required. The mixture is blended and is formed into a sheet of a thickness of 5 mm or less through heated pressure rolls and then is wound into a roll. If necessary, the roll of the base sheet is unwound and an adhesive coated on a release paper in a thickness of 50 μm or more is superposed on the lower surface of the base sheet and then the base sheet is wound again.

The base sheet may be composed of two layers; i.e., a base layer made of the above described ingredients and a thin colored layer provided on the base layer. In this two layered structure, the thickness of the base layer preferably is about 1.0 mm - 1.6 mm and the thickness of the colored layer preferably is about 20 μm - 25 μm. The thin colored layer on the base layer is required to have the same features as those of the base layer described above, to be adhered integrally to the base layer and to be colored in a desired color for the pavement marking purpose so that the same material as, or a material which is different but has the same properties as, the unvulcanized synthetic rubber used for the base layer added with a suitable coloring agent is preferably employed.

For forming the colored layer on the base layer, the base layer which has once been wound into a roll is unwound and the colored layer is formed thereon by coating a liquidized material prepared by dissolving an unvulcanized synthetic rubber material in a solvent and adding a coloring agent affording a desired color thereto on the upper surface of the base layer by an amount sufficient for giving a desired thickness to the coated film after drying.

The main ingredient and filler constituting the base layer and the colored layer need not be of the same composition if these layers adhere well to each other. The composition, thickness, the ratios of additives, the diameter and amount of the small glass microspheres, the kind and amount of the coloring agent etc. may be suitably determined having regard to the purpose of the sheet material.

The surface of the base sheet may be either flat or formed with a continuous pattern of multiplicity of protuberances and depressions. The depth of embedding of the glass microspheres may be either uniform or not uniform. Most preferably, the base sheet is formed on the surface thereof with a continuous pattern of a multiplicity of protuberances and depressions, the portion S in which the glass microspheres A and B are embedded is provided at intervals in the longitudinal direction of the base sheet or continuously in the longitudinal direction of the base sheet in a part of the base sheet as viewed in the transverse direction of the base sheet and the glass microspheres A and B in this portion S are embedded in such a manner that a depth of embedding of these glass microspheres A and B in the base sheet from the surface is randomly different one from another and a majority of the glass microspheres A and B in these protuberances and depressions are partially exposed from the surface of the base sheet.

According to this construction, a sufficient amount of light can be reflected back toward its light source, no matter which direction the light may be incident from so that a high initial brightness in reflection can be obtained in an initial stage of use of the pavement marking sheet material. Further, since the glass microspheres A and B are embedded in the surface portion of the protuberances and depressions of the base sheet in such a manner that the depth of embedding is randomly different one from another, the loss or sharp

decrease in the brightness in reflection never occurs as in prior art pavement marking sheet materials even when the brightness decreases due to coming off of the glass microspheres caused by contact with wheels of the passing vehicle but a high brightness in reflection is maintained for a long period of time. Since the depth of embedding of the glass microspheres embedded in the surface portion of each protuberance and depression is randomly different, when the glass microspheres contact wheels of the passing vehicle, the glass microspheres come off one after another in the order of the depth of embedding, i.e., a glass microsphere of a smaller depth of embedding coming off earlier, and never come off substantially all at once as in the prior art pavement marking sheet materials. Accordingly, the sheet material can maintain a high brightness in reflection until a layer of glass microspheres of the largest depth of embedding comes off.

In a case where the glass microspheres A are dispersed continuously over the entire surface of the base sheet and the glass microspheres B are dispersed at intervals in the longitudinal direction of the base sheet, it is preferable that the depth of embedding of a majority of the glass microspheres embedded in the surface portion of the base sheet should differ randomly not only in the portion S in which the glass microspheres A and B coexist mixedly but also in the portion in which the glass microspheres A only are dispersed.

Fig. 1 shows an example of the preferable form of the base sheet. Fig. 1 is an enlarged sectional view of the base sheet of Fig. 2 taken along lines I - I in Fig. 2. A continuous pattern of a multiplicity of protuberances 2 and depressions 3 of random shapes and dimensions is formed on the surface of a base sheet 1. A multiplicity of glass microspheres A and B are embedded in the base sheet 1 in such a manner that a depth of embedding of the glass microspheres A and B in the base sheet 1 from the surface of each protuberance 2 and depression 3 is randomly different one from another. A majority of the glass microspheres A and B in these protuberances 2 and depressions 3 are partially exposed from the surface of the base sheet 1 and the height of the exposed portion of these partially exposed glass microspheres is randomly different one from another. Reference numerals 4, 5 and 6 designate respectively an adhesive layer, small glass microspheres and wear resisting particles.

A process for manufacturing the sheet material will now be described about a sheet material in which the glass microspheres A are dispersed over the entire surface of the base sheet including both the portion S and the rest of the base sheet and the depth of embedding of the glass microspheres in the surface portion of each protuberance and depression of the base sheet is randomly different in both the portion S and the rest of the base sheet.

The base sheet 1 manufactured in the above described manner is unwound from the roll and a solvent is coated on the unwound base sheet 1 for facilitating embedding of the glass microspheres A and B. Then, the glass microspheres A are uniformly dispersed from a hopper (not shown) over an undried surface of the moving base sheet 1. Thereafter, the glass microspheres B are dispersed from another hopper (not shown) disposed downstream from the hopper containing the glass microspheres A over the undried surface of the base sheet intermittently at predetermined time intervals or, alternatively, continuously over a part of the base sheet as viewed in the transverse direction of the base sheet. The base sheet then is dried. As alternative means for facilitating embedding of the glass microspheres A and B, a coating material which is of a composition identical or similar to that of the base sheet 1 may be coated on the surface of the base sheet 1. Then, the base sheet 1 on which the glass microspheres A and B are dispersed is passed through an embossing device so that an embossed pattern of desired shape and dimensions is formed and simultaneously the glass microspheres A and B are embedded in the surface portion of each protuberance 2 and depression 3 of the base sheet 1 thus formed by the embossing.

The embossing device used in making the sheet material of the invention is one whose protuberances and depressions respectively are not of a flat surface, if viewed in an enlarged scale, but are formed with a multitude of small depressions with depth and diameter ranging from several tens microns to several hundred microns. By virtue of employing this embossing device, in carrying out the embossing process, many of the glass microspheres A and B are engaged in these small depressions formed on each of the sufaces of the protuberances and depressions constituting the embossing pattern of the embossing device and, accordingly, the material of the base sheet 1 entering each of these small deressions is stopped at a line along which the glass microsphere is engaged with the inside wall of the small depression and thereby is prevented from further entering the inside of the small depression to enclose the glass microsphere entirely by the material of the base sheet 1. Since the shape, diameter and depth of these small depressions are not uniform on one hand and the diameter of the glass microspheres A and B is varied within a certain range on the other, position of engagement of the glass microspheres A and B in the small depressions is infinitely varied depending upon combination of each individual small depression and each individual glass microsphere.

Accordingly, as shown in Fig. 1, a multiplicity of glass microspheres A and B whose depth of embedding is randomly different one from another are embedded in the surface portion of the respective protuberances 2 and depressions 3 of the base sheet 1 formed through the embossing process. If necessary, the surface of the embossed base sheet 1 is treated with a releasing agent. The base sheet 1 thereafter is dried and wound into a roll to provide a finished product.

The method of providing protuberances and depressions on the surface of the base sheet 1 is not limited to the above described embossing process but any other method capable of forming a multitude of continuous protuberances and depressions may be employed. In case the embossing device is employed, it is effective in some case to apply the embossing process twice depending upon the embossing pattern of the embossing device used.

Example 1

The following ingredients were used for producing the base sheet 1:

NBR	85 (parts by weight)
TiO_2	100
$CaCO_3$	140
petroleum resin	15
small glass microspheres (average diameter 100 μm)	140

These materials were blended and formed into a sheet having a thickness of 1.6 mm and a width of 1,000 mm through an extrusion process at a processing temperature of 90°C. The sheet was once wound and then, as the sheet was unwound, a release paper coated with pressure sensitive adhesive was superposed on the lower surface of the sheet. The sheet was wound again. Then, the sheet was unwound and triol was coated on the surface of the base sheet in a coating amount of 5 g - 6 g. Glass microspheres A having an average diameter of 350 μm and refractive index of 1.50 were uniformly dispersed over the undried surface of the base sheet. Glass microspheres B having an average diameter of 70 μm and refractive index of 2.2 were dispersed over the base sheet to form a belt-like section of a width of 25 mm at an interval of 300 mm in the longitudinal direction of the base sheet. The base sheet was then dried at 80°C for 5 minutes.

The base sheet was then passed through an embossing device at an embossing temperature of 80°C whereby the glass microspheres were densely embedded in the surface portion of protuberances and depressions formed on the base sheet. For providing a layer of releasing agent on the surface of the base sheet thus having the glass microspheres embedded therein, a releasing agent comprising a synthetic resin as a main ingredient was coated on the base sheet. The base sheet was then dried and wound into a roll to provide a finished product. Since an excessive thickness of the releasing agent layer decreases the brightness in reflection, the coating thickness of the releasing agent on the glass microspheres should be less than about 2 μm.

In applying this sheet material to the pavement surface to form, e.g., a center line thereon, the sheet material is cut into a belt of a suitable width, e.g., 150 mm.

Example 2

A base sheet of two layer structure consisting of the base layer and the colored layer of the following composition was manufactured:

Base layer	
chloro-sulphonyl-polyethylene	80
	(parts by weight)
BR	20
softener	20
filler	270
small glass microspheres (average diameter of 100 µm)	150
coloring agent	15
Colored layer	
chloro-sulphonyl-polyethylene	100
pigment	150
solvent (triol)	500

These materials were blended and formed into a sheet having a thickness of 1.6 mm and a width of 1,000 mm through an extrusion process at a processing temperature of 90°C. The sheet was once wound and then, as the sheet was unwound, the above described materials for forming the colored layer were coated on the sheet. The sheet was dried to form a base sheet having the colored layer of a thickness of 20 µm. After winding the sheet into a roll, the processings including superposition of a releasing paper, dispersion of the glass microspheres A and B and embossing were carried out in the same manner as described with respect to Example 1 to produce a finished product.

Example 3

A base sheet of two layer structure of the base layer and the colored layer of the following compositions was manufactured:

Base layer	
NBR	70
	(parts by weight)
BR	10
chloro-sulphonyl-polyethylene	10
filler	270
stearic acid	1.5
small glass microspheres	150
(average diameter of 100 μm)	
coloring agent	15
Colored layer	
chloro-sulphonyl-polyethylene	100
pigment	150
solvent (triol)	500

A base sheet having a base layer of a thickness of 1.6 mm and a width of 1,000 mm and a colored layer of a thickness of 20 μm is formed by the same process as in Example 2 and superposition of a release paper and coating of solvent were carried in the same manner as in Example 2. Then, glass microspheres B having an average diameter of 80 μm and refractive index of 2.2 were dispersed over the base sheet in the form of a belt-like section of a width of 30 mm at an interval of 350 mm in the longitudinal direction of the base sheet. These glass microsphers B were embedded substantially uniformly into the base sheet by a depth of about 40 μm by applying a light pressure over them by means of a roll. Thereafter, glass microspheres A having an average diameter of 200 μm and refractive index of 1.9 were dispersed over the base sheet substantially uniformly and these glass microspheres A were embedded into the base sheet by a depth of about 60 μm by applying a light pressure over them by means of a roll. The base sheet was dried at 80°C for 5 minutes and then wound into a roll. A sheet material in which the glass microspheres A and B are embedded in a base sheet of a flat surface was obtained.

Claims

1. An all-weather type pavement marking sheet material comprising:
a base sheet made of rubber, synthetic resin or the like; and
glass microspheres having refractive index of 1.5 - 1.9 and glass microspheres having refractive index of 2.0 - 2.4 embedded mixedly and at least partially in a portion of the base sheet, said portion being formed at intervals in the longitudinal direction of the base sheet or continuously in the longitudinal direction of the base sheet in a part of the base sheet as viewed in the transverse direction of the base sheet.

2. An all-weather type pavement marking sheet material as defined in claim 1 wherein the glass microspheres having refractive index of 1.5 - 1.9 are of a diameter of 50 μm - 1,000 μm and the glass microspheres having refractive index of 2.0 - 2.4 are of a diameter of 50μm - 350 μm.

3. An all-weather type pavement marking sheet material as defined in claim 1 wherein the glass microspheres having refractive index of 1.5 - 1.9 are dispersed over 30% - 40% of the area of a flat sheet before embossing and the glass microspheres having refractive index of 2.0 -2.4 are dispersed over 50% - 85% of the area of the flat sheet before embossing remaining after the glass microspheres having

refractive index of 1.5 - 1.9 have been dispersed.

4. An all-weather type pavement marking sheet material as defined in claim 1 wherein the base sheet is composed of a base layer and a thin colored layer provided on the base layer.

5. An all-weather type pavement marking sheet material as defined in claim 1 wherein the base sheet is formed on the surface thereof with a continuous pattern of a multiplicity of protuberances and depressions and the glass microspheres in said portion of the base sheet are embedded in these protuberances and depressions in such a manner that a depth of embedding of these glass microspheres in the base sheet from the surface is randomly different one from another and a majority of the glass microspheres in these protuberances and depressions are partially exposed from the surface of the base sheet.

6. An all-weather type pavement marking sheet material as defined in claim 1 wherein said portion of the base sheet is provided in the form of a belt-like section extending normally with respect to the longitudinal direction of the base sheet.

7. An all-weather type pavement marking sheet material as defined in claim 1 wherein said portion of the base sheet is provided in the form of a belt-like section extending obliquely with respect to the longitudinal direction of the base sheet.

8. An all-weather type pavement marking sheet material as defined in claim 1 wherein said portion of the base sheet is provided in the form of a broken line in the longitudinal direction of the base sheet.

9. An all-weather type pavement marking sheet material as defined in claim 1 wherein said portion of the base sheet is provided in the form of a belt extending continuously in the longitudinal direction of the base sheet in a part of the base sheet as viewed in the transverse direction of the base sheet.

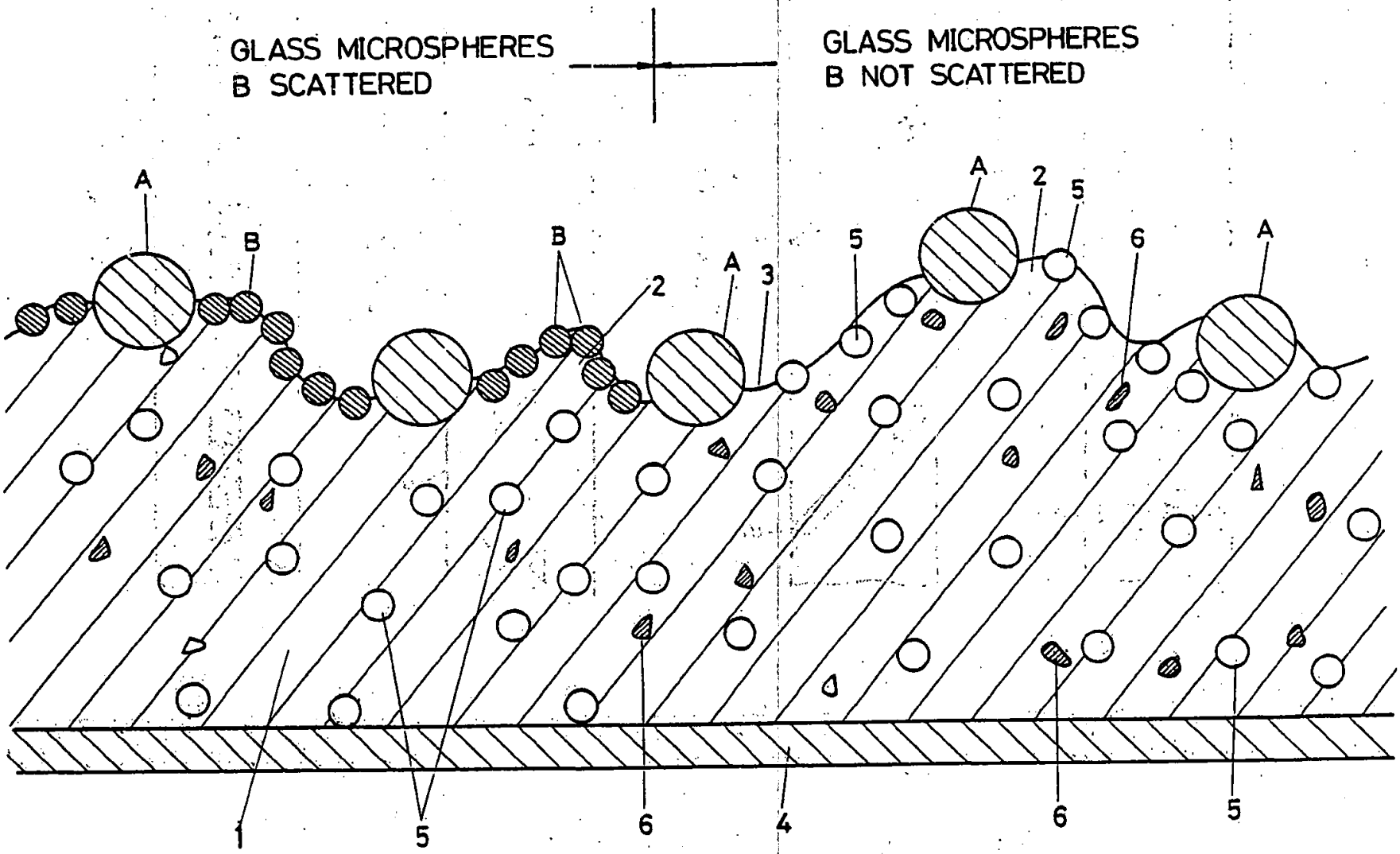

FIG.1

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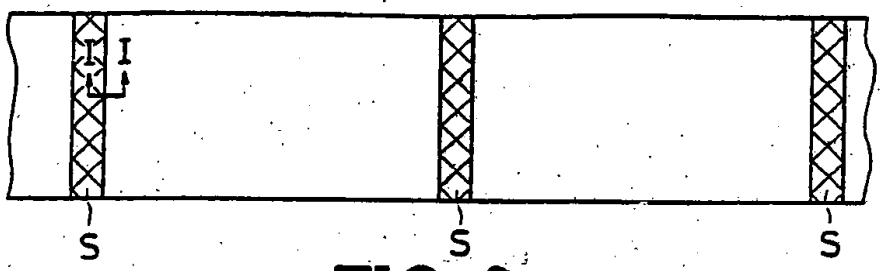

FIG. 2

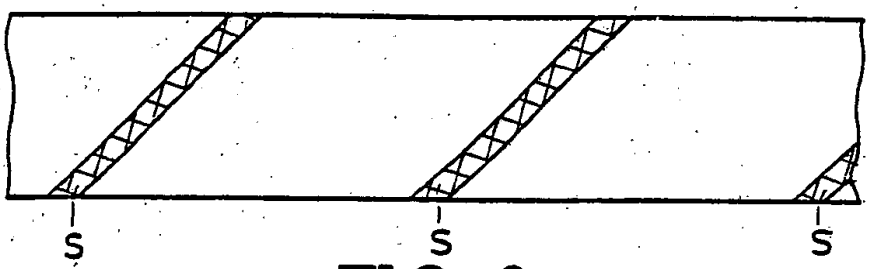

FIG. 3

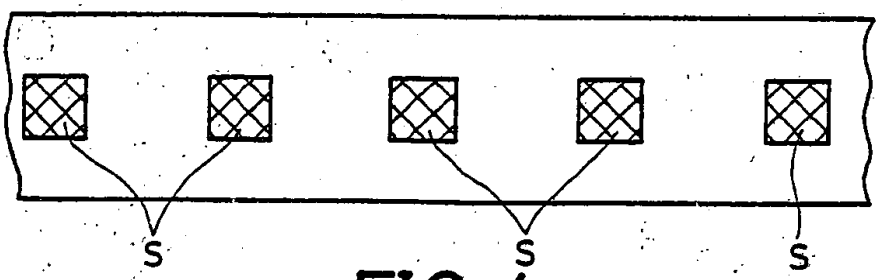

FIG. 4

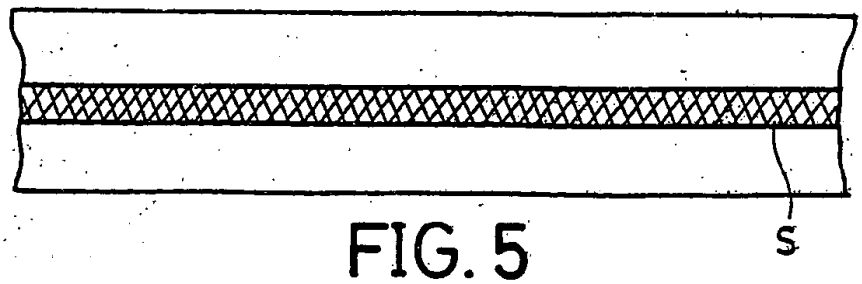

FIG. 5

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(54) All-weather type pavement marking sheet material.

(57) In an all-weather type pavement marking sheet material, glass microspheres having refractive index of 1.5 - 1.9 (A) and glass microspheres having refractive index of 2.0 - 2.4 (B) are embedded mixedly and at least partially in a portion of a base sheet (1) made of rubber, synthetic resin or the like. This portion (S) is formed at intervals in the longitudinal direction of the base sheet or continuously in the longitudinal direction of the base sheet in a part of the base sheet as viewed in the transverse direction of the base sheet. The pavement marking sheet material has an excellent visibility during night and particularly when it is raining.

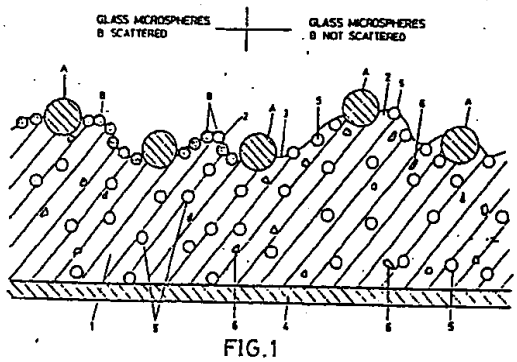

FIG.1

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DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.3)
Y,A	EP-A-0 101 084 (EIGENMANN) * page 4, line 30 - page 5, line 3; figure 1 *	1,8	E 01 F 9/04 E 01 F 9/08
Y,A	US-A-3 915 771 (GATZKE et al.) * column 1, line 27 - column 3, line 65; figure *	1,2,4	
A	DE-U-7 713 988 (MINNESOTA MINING AND MANUFACTURING CO.) * page 6, paragraph 2 - page 14; figure *	1,2,4	
A	AT-B- 307 282 (EIGENMANN) * whole document *	1,2	
A	DE-A-1 784 541 (PRISMO SAFETY CORP.) * page 4 - page 8, paragraph 2; figures 1-5 *	1,8	
A	US-A-3 215 051 (GILL) * column 2, lines 64-70; figures 1,2 *	1,9	TECHNICAL FIELDS SEARCHED (Int. Cl.3)
A	GB-A-1 107 799 (TARKETT AB) * claim 1; figures 1,2 *	1,5	E 01 F 9/00
A	US-A-4 388 359 (ETHEN et al.) * column 2, line 38 - column 4, line 31; figure *	1,5	
A	DE-A-2 117 765 (EIGENMANN) * claims 1-4 *	1,2	
A	US-A-4 069 281 (EIGENMANN) * column 3, line 31 - column 6, line 41; figures 1-11 *	1,6	

-/-

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	21-03-1988	PAETZEL H-J

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Application Number

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DOCUMENTS CONSIDERED TO BE RELEVANT

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D,A	JP-A-60 238 505 * figures 1-8 * -----	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.3)

The present search report has been drawn up for all claims

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